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System perspective in material flow analysis for LCA studies

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INTRODUCTION

Plastics are produced in large volumes and used in many industrial sectors. However, there is a lack of comprehensive understanding of plastic flows from a system perspective. Material Flow Analysis (MFA) accounts for material inputs, outputs and stocks for a selected material. MFA is essential when performing a Life Cycle Assessment (LCA) of waste management systems. This work illustrates a system perspective when performing MFA of plastics in Europe.

METHODOLOGY

Flows of plastics in the European Union (EU) were estimated for a variety of polymers used in selected industrial sectors (packaging, agriculture, etc.). An example of polypropylene (PP) polymer is presented here. Both pre-consumer and post-consumer plastic waste was considered when quantifying flows of plastics in different waste management alternatives. Data presented here represent preliminary results of an ongoing research.

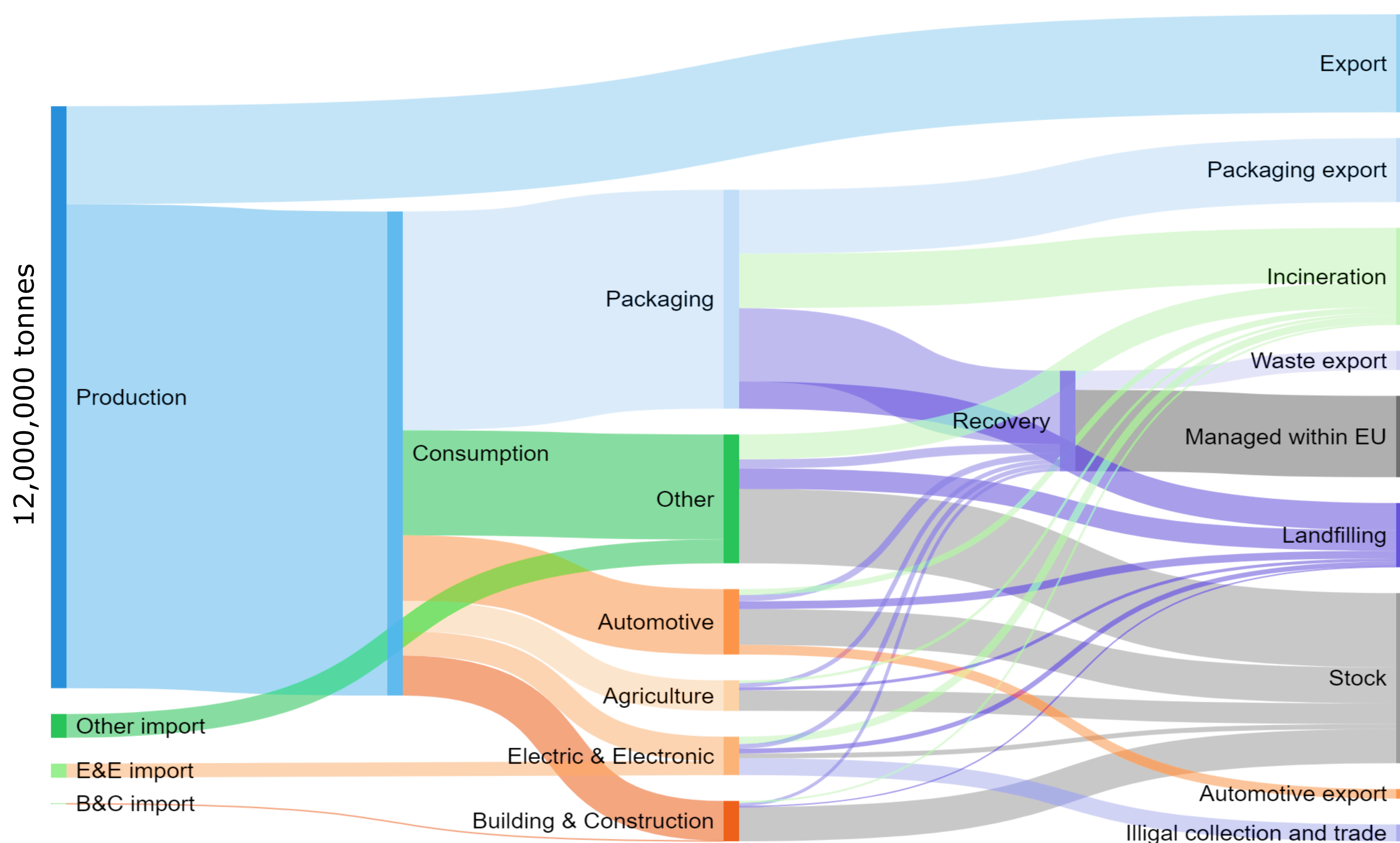


Figure 1. Overview of polypropylene (PP) flows in the EU.

RESULTS AND CONCLUSIONS

- Approximately 12,000,000 tonnes of PP polymer are annually produced in the EU and 20% are exported
- Roughly half of PP is used in packaging, followed by "other" (20%) and automotive (15%) sectors
- The six industrial sectors considered generate more than 5,000,000 tonnes of PP waste in the EU
- Approximately 40% of the (pre- and post-consumer) waste PP is collected for reprocessing and recycling
- Collection efficiency of the waste PP varies between 20% and 50% depending on industrial sector
- Almost 20% of the collected waste PP is exported outside of the EU for further sorting and reprocessing
- Less than 20% of PP consumed in the EU comes from recycled plastics (assuming no imports of recycled PP)
- LCA can be used to optimize environmental performance of the waste plastic management system
- Results of a potential LCA will depend on the choice of a material being displaced by recycled PP
- Potential chemical contamination of PP waste (e.g., BFRs (Pivnenko et al., 2017)) should be considered